Geometry
Mathematics
Item Specifications

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High School Geometry

Introduction

In 2014 Missouri legislators passed House Bill 1490, mandating the development of the Missouri Learning Expectations. In April of 2016, these Missouri Learning Expectations were adopted by the State Board of Education. Groups of Missouri educators from across the state collaborated to create the documents necessary to support the implementation of these expectations.

One of the documents developed is the item specification document, which includes all Missouri grade level/course expectations arranged by domains/strands. It defines what could be measured on a variety of assessments. The document serves as the foundation of the assessment development process.

Although teachers may use this document to provide clarity to the expectations, these specifications are intended for summative, benchmark, and large-scale assessment purposes.

Components of the item specifications include:

Expectation Unwrapped breaks down a list of clearly delineated content and skills the students are expected to know and be able to do upon mastery of the Expectation.

Depth of Knowledge (DOK) Ceiling indicates the highest level of cognitive complexity that would typically be assessed on a large scale assessment. The DOK ceiling is not intended to limit the complexity one might reach in classroom instruction.

Item Format indicates the types of items used in large scale assessment. For each expectation, the item format specifies the type best suited for that particular expectation.

Text Types suggests a broad list of text types for both literary and informational expectations. This list is not intended to be all inclusive: other text types may be used in the classroom setting. The expectations were written in grade level bands; for this reason, the progression of the expectations relies upon increasing levels of quantitative and qualitative text

complexities.

Content Limits/Assessment Boundaries are parameters that item writers should consider when developing a large scale assessment. For example, some expectations should not be assessed on a large scale assessment but are better suited for local assessment.

Sample stems are examples that address the specific elements of each expectation and address varying DOK levels. The sample stems provided in this document are in no way intended to limit the depth and breadth of possible item stems. The expectation should be assessed in a variety of ways.

High School Geometry

Mathematics		G.CO.A.1
CO A 1	**Congruence** **Experiment with transformations in the plane.** Define angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will precisely define angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc. The student will use definitions that will be built based on the undefined terms in Geometry.		**DOK Ceiling** 1 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CO.A.2
CO A 2	**Congruence** **Experiment with transformations in the plane.** Represent transformations in the plane, and describe them as functions that take points in the plane as inputs and give other points as outputs.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will represent transformations in the plane using descriptions of functions that takes points in the plane as inputs and transforms them as outputs. The student will compare transformations and describe the horizontal and vertical shifts of functions to those that do not. The student will interpret all the transformations (translation, rotations, reflections, dilations)		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CO.A.3
CO A 3	**Congruence** **Experiment with transformations in the plane.** Describe the rotational symmetry and lines of symmetry of two-dimensional figures.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will describe the rotational symmetry of two- dimensional figures. For example given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. The student will describe the lines of symmetry of two- dimensional figures. The student will calculate the number of lines of reflection symmetry and the degree of rotational symmetry of any regular polygon.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CO.A.4
CO A 4	**Congruence** **Experiment with transformations in the plane.** Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will develop definitions from the given terms of angles, circles, perpendicular lines, parallel lines and line segments to create rotations, reflections and translations, using previous comparisons and descriptions of transformations. The student will observe patterns and develop definitions of rotations, reflections, and translations by using manipulatives, constructions, Geoboards or geometry software.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

<table>
<tr><th colspan="2">Mathematics</th><th>G.CO.A.5</th></tr>
<tr><td>CO
A
5</td><td colspan="2">Congruence
Experiment with transformations in the plane.
Demonstrate the ability to rotate, reflect or translate a figure, and determine a possible sequence of transformations between two congruent figures.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.</u>

The student will demonstrate their ability to rotate, reflect or translate a figure.

The student will determine possible transformations that carry a geometric figure onto itself following a sequence of transformations between two congruent figures, by using multiple facets of creation.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced

<u>Sample Stems</u></td></tr>
<tr><td colspan="2"><u>State Assessment Content Limits/Boundaries Classroom Work Should Include Extension</u>
No more than a sequence of two transformations.</td><td><u>Calculator Designation</u>

YES – a calculator will be available for items</td></tr>
</table>

High School Geometry

Mathematics		G.CO.B.6
CO B 6	**Congruence** **Understand congruence in terms of rigid motions.** Develop the definition of congruence in terms of rigid motions.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will be able to develop the definition of rigid motions (translations, rotations, reflections) to transform figures and predict the effect of the rigid motion.

The student will use a sequence of rigid motion to transform a pre-image to an image.

The student will know that rigid transformations preserve angle measure, betweenness, collinearity and distance.

The student will use the properties of rigid transformations to develop the definition of congruent

Determine if two figures are congruent by determining if rigid motions will turn one figure into the other.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
No more than a sequence of two transformations.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CO.B.7
CO B 7	**Congruence** **Understand congruence in terms of rigid motions.** Develop the criteria for triangle congruence from the definition of congruence in terms of rigid motions.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will be able to develop the criteria for triangle congruence, if and only if corresponding sides and corresponding angles are maintaining their angle measure and side lengths from rigid transformations (that when distance is preserved, corresponding sides are congruent, and angle measure is preserved, corresponding angles are congruent, the triangles must also be congruent) The student will be able to develop the triangle congruence criteria (ASA, AAS, SAS and SSS) by using the appropriate rigid motions definitions to minimize requirements for congruence of triangles.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CO.C.8
CO C 8	**Congruence** **Prove geometric theorems.** Prove theorems about lines and angles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will prove theorems about lines and angles.

The student will be able to prove theorems using the following, but not limited to: perpendicular bisector, parallel lines, angle bisector, linear pairs, supplementary angles, complementary angles, vertical angles, corresponding angles, alternate interior angles and alternate exterior angles.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CO.C.9
CO C 9	**Congruence** **Prove geometric theorems.** Prove theorems about triangles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will prove theorems and interpret geometric diagrams by identifying what can and cannot be assumed about triangles.

The student will be able to prove theorems using the following, but not limited to triangle sum, exterior angle, properties of special triangles, midpoints, medians, angle bisectors, mid-segment, ASA, AAS, SAS, SSS and HL.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CO.C.10
CO C 10	**Congruence** **Prove geometric theorems.** Prove theorems about polygons.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. Student will prove theorems about polygons, which will include, but will not be limited to parallelograms, kites, trapezoids, hexagons. The student will use geometric simulations (computer software or graphing calculator) to explore theorems about polygons. The student will use theorems to solve problems involving polygons.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension Proofs are not limited to parallelograms or quadrilaterals.		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CO.D.11
CO D 11	**Congruence** **Make geometric constructions.** Construct geometric figures using various tools and methods.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will construct geometric figures using various tools and methods.

The student will be able to construct basic geometric components using a compass and straightedge, or with any of the following that may be available: string, reflective devices, paper folding, tracing paper and dynamic geometric software.

The student will be able to do basic constructions and explain how these constructions result in the desired objects such as copying a segment, copying an angle, bisecting an angle, constructing perpendicular lines, construct perpendicular bisectors, constructing parallel lines, construct a parallel line through a point not on a line.

The student will be able to articulate the steps of construction in sequence.

The student will be able to construct specific geometric shapes such as regular hexagons inscribed in circles, equilateral triangles, squares.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
On assessment state the next step of construction in the process.
Some constructions may not be able to be assessed.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.SRT.A.1
SRT **A** **1**	**Similarity, Right Triangles, and Trigonometry** **Understand similarity in terms of similarity transformations.** Construct and analyze scale changes of geometric figures.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will construct and analyze scale changes of geometric figures by verifying with experimentation the properties of dilations when given a center and a scale factor.

The student will use dilation by taking a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

The student will be able to determine the dilation of line segment is an enlargement or reduction in the same ratio as the scale factor and verify that a side length of the image is equal to the scale factor multiplied by the corresponding side length of the preimage.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
Limit to the center of dilation to the origin for those that are on the coordinate plane.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.SRT.A.2
SRT A 2	**Similarity, Right Triangles, and Trigonometry** **Understand similarity in terms of similarity transformations.** Use the definition of similarity to decide if figures are similar and to solve problems involving similar figures.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use the definition of similarity to decide if figures are similar to solve problems.

The student will use the definition of similarity by examining corresponding side length to see they are in the same ratio of similar figures. The corresponding angle measures of similar figures are congruent.

The student will use the idea of dilation transformations to develop the definition of similarity. Understand that a similarity transformation is a combination of a rigid motion and a dilation.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.SRT.A.3
SRT A 3	**Similarity, Right Triangles, and Trigonometry** **Understand similarity in terms of similarity transformations.** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. (Third angle Theorem)

The student will identify and explain that AA similarity is a sufficient condition for two triangles to be similar.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

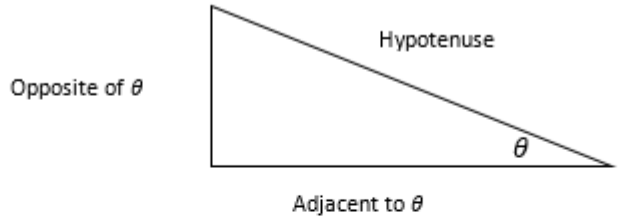
Mathematics		G.SRT.B.4
SRT **B** **4**	**Similarity, Right Triangles, and Trigonometry** **Prove theorems involving similarity.** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will prove theorems about triangle similarity this will include, but not be limited to AA~, SSS~, SAS~, H-L~, Triangle Proportionality Theorem, Side-Splitter Theorem (or triangle proportionality theorem). The student will use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. The student will use geometric simulation software to model transformations and demonstrate a sequence of transformations to show congruence or similarity of figures.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.SRT.C.5
SRT C 5	**Similarity, Right Triangles, and Trigonometry** **Define trigonometric ratios, solve problems involving right triangles.** Understand that side ratios in right triangles define the trigonometric ratios for acute angles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will understand, using similarity, that side ratios in right triangles define the trigonometric ratios for acute angles.



$\sin of\ \theta = \sin\theta = \frac{opposite}{hypotenuse}$

$\text{cosecant}\ of\ \theta = \csc\theta = \frac{hypotenuse}{opposite}$

$\text{cosine}\ of\ \theta = \cos\theta = \frac{adjacent}{hypotenuse}$

$\text{secant}\ of\ \theta = \sec\theta = \frac{hypotenuse}{adjacent}$

$\text{tangent}\ of\ \theta = \tan\theta = \frac{opposite}{adjacent}$

$\text{cotangent}\ of\ \theta = \cot\theta = \frac{adjacent}{opposite}$

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.SRT.C.6
SRT C 6	**Similarity, Right Triangles, and Trigonometry** **Define trigonometric ratios, solve problems involving right triangles.** Explain and use the relationship between the sine and cosine of complementary angles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.	**DOK Ceiling** 2
The student will explain and use the relationship between the sine and cosine ratios for acute angles in a right triangle when given two side lengths. Use a diagram of a right triangle to explain that for a pair of complimentary angles A and B, the sine of angle A is equal to the cosine of angle B and the cosine of angle A is equal to the sine of angle B.	**Item Format** Selected Response Constructed Response Technology Enhanced
	Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension	**Calculator Designation** **YES** – a calculator will be available for items

High School Geometry

Mathematics		G.SRT.C.7
SRT C 7	**Similarity, Right Triangles, and Trigonometry** **Define trigonometric ratios, solve problems involving right triangles.** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use Pythagorean Theorem to find missing sides of right triangles and use trigonometric ratios to solve for missing sides or angles.

The student will use trigonometric ratios to find missing sides of right triangles to solve for missing sides or angles.

The student will use calculators, graphing calculators or programs, tables, spreadsheets, or computer algebra systems to solve right triangle problems.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
Problems can require solving using trigonometric ratios alone but not using Pythagorean theorem alone to align at this level.

Calculator Designation

YES – a calculator will be available for items

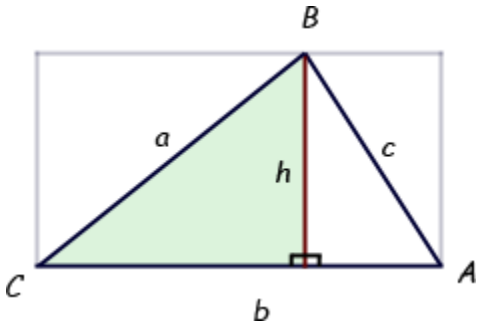
High School Geometry

Mathematics	G.SRT.C.8
SRT C 8	**Similarity, Right Triangles, and Trigonometry** **Define trigonometric ratios, solve problems involving right triangles.** Derive the formula A = 1/2 ab sin(C) for the area of a triangle.

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use trigonometric ratios to derive the formula $A = ½\ ab\ sin\ C$ to solve for the area of a triangle.

The student will use the area formula of a rectangle and right triangle trigonometry functions to derive the formula for $A = ½\ ab\ sin\ C$.



DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.C.A.1
C **A** **1**	**Circles** **Understand and apply theorems about circles** Prove that all circles are similar using similarity transformations.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will prove that all circles are similar using similarity transformations by dilations.

The student will prove that all circles are similar by showing that for a dilation centered at the center of a circle, the preimage and the image have equal central angle measures.

The student will use the fact that the ratio of circumference to diameter is the same for circles; prove that all circles are similar.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.C.A.2
C **A** **2**	**Circles** **Understand and apply theorems about circles** Identify and describe relationships among inscribed angles, radii and chords of circles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.	**DOK Ceiling** 2
The student will be able to identify all parts of the circle and the relationships among the inscribed angles and the intercepted arc. The student will be able to identify the relationships between but not limited to the radii, diameter, tangent lines, secant lines and the chords of a circle. The student will describe the relationship between a circumscribed angle and the arcs it intercepts. Recognize that an inscribed angle whose sides intersect the endpoints of the diameter of a circle is a right angle. The student will recognize that the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	**Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension	**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.C.A.3
C **A** **3**	**Circles** **Understand and apply theorems about circles** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will construct the inscribed circle by finding the incenter, which is formed by the intersection of the angle bisectors of the triangle.

The student will construct an inscribed triangle by finding the circumcenter, which is formed by the intersection of the perpendicular bisectors of the triangle.

The student will prove the properties of angles for a quadrilateral inscribed in a circle by using relationships of inscribed and their intercepted arcs.

DOK Ceiling
3

Item Format
Selected Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
On assessment limit to more vocabulary type questions or description to create construction.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.C.B.4
C **B** **4**	**Circles** **Find arc lengths and areas of sectors of circles.** Derive the formula for the length of an arc of a circle.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use similarity, that the fact of the length of the arc intercepted by an angle is proportional to the radius.

The student will derive the formula for length of an arc of a circle by using similarity of circles.

The student will use the introduction of radian measure to derive the formula for the length of an arc of a circle.

Note: both radians and degree will be possibly used in problems tied to this expectation

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.C.B.5
C **B** **5**	**Circles** **Find arc lengths and areas of sectors of circles.** Derive the formula for the area of a sector of a circle.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will derive the formula for the area of a circle by using the ratio of the arc length.

The student will use radian measure to derive the formula for the area of a sector of a circle.

Note: both radians and degree will be possibly used in problems tied to this expectation

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.GPE.A.1
GPE **A** **1**	**Exploring Geometric Properties with Equations** **Translate between the geometric description and the equation for a conic section.** Derive the equation of a circle.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will derive the equation of a circle when given the center and a point on the circle by using Pythagorean Theorem.
The student will derive the equation of a circle to find the center and radius by completing the square.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.GPE.A.2
GPE **A** **2**	**Exploring Geometric Properties with Equations** **Translate between the geometric description and the equation for a conic section.** Derive the equation of a parabola given a focus and directrix.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will derive the equation of a parabola given a focus and directrix by using the distance from the focus and a point on the parabola being equal to the distance from the same point on the parabola to the directrix.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension The answer needs to be in the standard form of parabola. The standard form of the equation of a parabola should be given on the formula sheet.		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.GPE.B.3
GPE **B** **3**	**Exploring Geometric Properties with Equations** **Use coordinates to prove geometric theorems algebraically.** Use coordinates to prove geometric theorems algebraically.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use Cartesian coordinates to prove geometric theorems algebraically in correspondence with the properties of special quadrilaterals.

The student will prove or disprove geometric theorems algebraically in triangles.

The student will use slope to determine if sides are parallel, intersecting, or perpendicular; use the distance formula to determine if sides are congruent; use the midpoint formula or the distance formula to decide if a side has been bisected.

The student will prove or disprove geometric theorems algebraically in circles.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
On assessment, vertices are on intersecting grid lines and coordinates are integers.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.GPE.B.4
GPE **B** **4**	**Exploring Geometric Properties with Equations** **Use coordinates to prove geometric theorems algebraically.** Prove the slope criteria for parallel and perpendicular lines and use them to solve problems.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.	**DOK Ceiling** 3
The student will prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. The student will determine whether two given lines are parallel, perpendicular or coincident. Lines can be horizontal, vertical or neither. Equations associated with these lines will have no solution, one solution or infinitely many solutions. The student may use a variety of different methods to construct a parallel or perpendicular line to a given line and calculate the slopes to compare relationships.	**Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension	**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.GPE.B.5
GPE **B** **5**	**Exploring Geometric Properties with Equations** **Use coordinates to prove geometric theorems algebraically.** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.	**DOK Ceiling** 3
The student will find the point on a directed line segment proportionally between two points that partitions the segment in a given ratio.	**Item Format** Selected Response Constructed Response Technology Enhanced
	Sample Stems
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension Limit ratio to simple ratios of thirds or fourths.	**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.GPE.B.6
GPE **B** **6**	**Exploring Geometric Properties with Equations** **Use coordinates to prove geometric theorems algebraically.** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.	**DOK Ceiling** 2
The student will use coordinates to compute perimeters of all polygons by using distance formula. The student will use coordinates to compute the areas of triangles and rectangles by using the distance formula to find the base and the height.	**Item Format** Selected Response Constructed Response Technology Enhanced
	Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension	**Calculator Designation**
Limit the ordered pairs between negative ten and ten.	**YES – a calculator will be available for items**

High School Geometry

Mathematics		G.GMD.A.1
GMD A 1	**Geometric Measurement and Dimension.** **Explain volume formulas and use them to solve problems.** Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid and cone.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will give an informal argument for the formulas for the circumference of a circle could be shown by various methods.
The student will give an informal argument for the formula for the area of a circle which may be shown using various methods.

When a figure in the plane results from another by applying similarity transformation with scale factor k; its area is k^2 times the area of the first.

The student will give an informal argument for the formulas of volume for a cylinder, pyramid and cone.

Similarly, volumes of solid figure scale k^3 under a similarity transformation with scale factor k.

The student will demonstrate informal arguments by using Cavalieri's Principle, if two solids have the same height and the same cross-sectional area at every level, then they have the same volume, for finding volumes of oblique cylinders, cones and pyramids.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.GMD.A.2
GMD A 2	**Geometric Measurement and Dimension.** **Explain volume formulas and use them to solve problems.** Use volume formulas for cylinders, pyramids, cones, spheres and composite figures to solve problems.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will use volume formula for cylinders, pyramids, cones and spheres to solve problems. Missing measures can include but are not limited to slant height, altitude, height, edge length, and radius. The student will use volume formulas of composite figures using combinations of cylinders, pyramids, cones and spheres.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.GMD.B.3
GMD **B** **3**	**Geometric Measurement and Dimension.** **Visualize relationships between two-dimensional and three-dimensional objects.** Identify the shapes of two-dimensional cross-sections of three-dimensional objects.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will identify/describe the shapes of two-dimensional cross-sections of three-dimensional objects.

The student will be able to determine the shape of a plane section parallel or perpendicular to the base of three-dimensional objects.

The student will be able to determine the shape of a plane section not parallel to, but not intersecting the base of three-dimensional objects.

The student may use geometric simulation software to model figures and create cross sectional views.

*change the 7th grade standard to **Identify** and make the Geometry standard to **Describe** the shapes…(7.GM.A.3)

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.GMD.B.4
GMD **B** **4**	**Geometric Measurement and Dimension.** **Visualize relationships between two-dimensional and three-dimensional objects.** Identify three-dimensional objects generated by transformations of two-dimensional objects.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will identify three-dimensional objects generated by transformations of two-dimensional objects.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
One side of the two-dimensional shape needs to be set on the axis or axes.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

<table>
<tr><th colspan="2">Mathematics</th><th>G.MG.A.1</th></tr>
<tr><td>MG
A
1</td><td colspan="2">Modeling with Geometry
Apply geometric concepts in modeling situations.
Use geometric shapes, their measures and their properties to describe objects.</td></tr>
<tr><td colspan="2" rowspan="2"><u>Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.</u>

The student will use geometric shapes, their measures and their properties to describe objects.</td><td><u>DOK Ceiling</u>
2</td></tr>
<tr><td><u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced

<u>Sample Stems</u></td></tr>
<tr><td colspan="2"><u>State Assessment Content Limits/Boundaries Classroom Work Should Include Extension</u></td><td><u>Calculator Designation</u>

YES – a calculator will be available for items</td></tr>
</table>

High School Geometry

Mathematics		G.MG.A.2
MG A 2	**Modeling with Geometry** **Apply geometric concepts in modeling situations.** Apply concepts of density based on area and volume in modeling situations.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will be able to apply concepts of density based on area and volume in modeling situations.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
Give formula for density in the prompt.

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.MG.A.3
MG A 3	**Modeling with Geometry** **Apply geometric concepts in modeling situations.** Apply geometric methods to solve design mathematical modeling problems.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will apply geometric methods to solve design mathematical modeling problems by using graphs, equation, table, formulas.

The student will interpret the results and make conclusions based on the geometric model.

The student may use simulation software and modeling software to explore which model best describes a set of data or situation.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CP.A.1
CP A 1	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections or complements of other events.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will describe events as subsets of a sample space (the set of outcomes) using characteristics of the outcomes, or as unions (“U” ; or), intersections (“∩” ; and) or complements (“ (A U B)’ “ ; not) of other events. The student will use correct set notation, with appropriate symbols, to identify sets and subsets.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CP.A.2
CP A 2	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Understand the definition of independent events and use it to solve problems.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will understand the definition of independent events and use it to solve problems.

The student will understand and explain properties of Independence and Conditional Probabilities, that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities using this characterization to determine if they are independent, $P(A \cap B) = P(A) \cdot P(B)$.

The student will use appropriate probability notation for individual events as well as their intersection (joint probability).

The student will calculate probabilities for events, including joint probabilities, using various methods.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CP.A.3
CP A 3	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Calculate conditional probabilities of events.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will calculate conditional probabilities of events.

The student will understand the conditional probability of A and B as **P(A | B) = P(A and B)/ P(B)**, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

The student will find the conditional probability of A given B as the fraction of B's outcomes that also belongs to A, and interpret the answer in terms of the model.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CP.A.4
CP A 4	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will determine when a two-way frequency table is an appropriate display for a set of data. Collect data from a random sample.

The student will construct and interpret two-way frequency tables of data using appropriate categories for each variable when two categories are associated with each object being classified.

Then student will then use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.
The student may use spreadsheets, graphing calculators, and simulations to create frequency tables and conduct analyses to determine if events are independent or determine approximate conditional probabilities.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CP.A.5
CP A 5	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Recognize and explain the concepts of conditional probability and independence in a context.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

The student will calculate conditional probabilities using the definition: 'the conditional probability of A given B as the fraction of B's outcomes that also belong to A'

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CP.A.6
CP A 6	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Apply and interpret the Addition Rule for calculating probabilities.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will identify two events as disjoint (mutually exclusive). P(A or B)= P(A) +P(B)
The student will apply and interpret the Addition Rule for calculating probabilities using
P(A or B)= P(A) +P(B) – P(A and B) and interpret the probability of unions and intersections in terms of the model

The student could use graphing calculators, simulations or applets to model probability experiments and interpret the outcomes.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension
Knowledge of specific games should not be assumed in assessing this expectation (cards, dice, sports, etc.)

Calculator Designation

YES – a calculator will be available for items

High School Geometry

Mathematics		G.CP.A.7
CP A 7	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Apply and Interpret the general Multiplication Rule in a uniform probability model.	
Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations. The student will apply and interpret the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B \mid A) = P(B)P(A \mid B)$.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
State Assessment Content Limits/Boundaries Classroom Work Should Include Extension		**Calculator Designation** **YES – a calculator will be available for items**

High School Geometry

Mathematics		G.CP.A.8
CP A 8	**Conditional Probability and Rules of Probability** **Understand independence and conditional probability and use them to interpret data.** Use permutations and combinations to solve problems.	

Expectation Unwrapped – the intent of this section is to describe the elements of the expectation, but are NOT additional standards or expectations.

The student will use permutations to solve problems, by using P(n,r) = $\frac{n!}{(n-r)!}$

The student will use combinations to solve problems by using C(n,r) = $\frac{n!}{(n-r)!r!}$

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

State Assessment Content Limits/Boundaries Classroom Work Should Include Extension

Calculator Designation

YES – a calculator will be available for items